



Outokumpu Oyj

Assessing the Long-term Effects of Exposure to Metals in Stainless Production

Safety

Challenge

Employees working in the stainless steel industry are exposed to potentially carcinogenic and toxic materials every day. Outokumpu wanted to understand the actual exposure levels and the chemical composition of the inhaled particles and to answer questions such as:

- Is it possible to stay healthy throughout an entire career in the stainless steel industry without contracting occupational diseases?
- How should we run proper periodic health examinations and effective health promotion campaigns?
- Are modern laboratory methods, such as the assessment of the micronuclei of nasal cells, useful tools to define the early biomarkers of potential cancer-forming cells in the respiratory tract?

An essential part of the challenge was to demonstrate that healthy and safe working conditions in the production phase are fundamental for the sustainability of stainless steel as material of the future.

Action

A systematic scientific research programme was developed in 1986, and has been carried out at Outokumpu's Tornio Works (Finland) in close cooperation with universities and expert institutes. In total, 316 workers participated in the follow-up studies. Their average exposure time was 23 years.

The studies have covered exposure characteristics, long-term respiratory health effects, nasal cell mutagenetic effects and magnetopneumographic examinations to determine the rate of dust retention in the lungs.

The results of the studies have been published as six individual articles in international scientific medical journals between 1993 and 2002. A new phase of the research programme is on-going.

Outcome

The exposure study showed that there is certainly exposure to chromium and nickel throughout the production chain, and to harmful hexavalent chromium at certain stages. However, the observed health effects were minimal. This finding can be explained partly by low exposure levels and partly by the low bio-availability of potentially harmful chromium species. The low bio-availability can be explained by the surface properties and chemical composition of the metal particles in the workplace air.

The clinical studies indicated that an average exposure time of 23 years in ferrochromium and stainless steel production, including exposure to dusts containing low concentrations of chromium and nickel compounds, do not lead to any respiratory changes detectable by lung-function tests or radiography nor to any increase in symptoms of respiratory diseases. Nor does this exposure lead to nasal changes detectable by clinical or cytological examination. No genotoxic effects attributable to occupational metal exposure could be observed.

The results demonstrated that the modern stainless steel production chain achieves low metal exposure levels with no adverse health effects. Results of the studies have been used in European Union chemical

safety procedures (such as REACH) and to scientifically show the health effects of stainless steel and industry.

Recommendations for health examinations have also been made based on these studies.

The publication of the results in open literature has made them available to the global stainless steel community and its stakeholders.

The scientific studies form the basis of the Finnish Institute of Occupational Health's (FIOH) Review of the Toxicity of Stainless Steel, conducted in 2010. For more information on this study, please visit:

http://www.ttl.fi/en/publications/Electronic_publications/Documents/Stainless_steel.pdf